UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 358

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief

Washington, D. C. PROFESSIONAL PAPER April 12, 1916

STUDIES OF THE MEXICAN COTTON BOLL WEEVIL IN THE MISSISSIPPI VALLEY

By

R. W. HOWE, Entomological Assistant, Southern Field Crop Insect Investigations

CONTENTS

	Page		Page
Introduction	1	Maximum Number of Eggs Per Day	24
Longevity of Adult Weevils	3	Period from Deposition of Last Egg to Death	24
Food Plants of the Weevil	8	Activity of Females in Different Parts of the Day	25
Feeding Habits on Cotton Leaves and Terminals	11	Cessation of Oviposition by Hibernated Weevils	26
Sex of Adults	12	Total Developmental Period	26
Period From Emergence to Oviposition	12	Effect of Size of Square on Weevil Development	30
Period From First Feeding on Squares to Oviposition	13	Generations	30
Fecundity	13	Summary	31
Oviposition Period	23		
Rate of Oviposition	24		

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	Page.		Page.
Introduction	1	Rate of oviposition	24
Longevity of adult weevils	3	Maximum number of eggs per day	24
Food plants of the weevil	8	Period from deposition of last egg to death	24
Feeding habits on cotton leaves and terminals	11	Activity of females in different parts of the day	25
Sex of adults	12	Cessation of oviposition by hibernated weevils	26
Period from emergence to oviposition	12	Total developmental period	26
Period from first feeding on squares to oviposition	13	Effect of size of square on weevil development	30
Fecundity	13	Generations	30
Oviposition period	23	Summary	31

INTRODUCTION.

Shortly after 1892, when the Mexican cotton-boll weevil (*Anthonomus grandis* Boh.) invaded Texas on its northward and eastward journey and its extreme importance was seen, complete data were secured on the various biological functions. In recent years, however, numerous observations have shown that, under new climatic and other environmental conditions to which the weevil has been subjected in its spread, changes have been taking place in many of these functions. In addition, a new variety of the boll weevil has been found breeding in a wild cotton (*Thurberia thespesioides*) occurring in the mountain ranges of southeastern Arizona, and this weevil (which has been described as *Anthonomus grandis thurberiae* Pierce) has been found to possess habits which differ in many ways from those of its near relative on cultivated cotton. Consequently, it has been necessary to repeat many studies under both the old and the new conditions and to include the new variety. In this way the

Note.—This bulletin is of interest to entomologists in the cotton belt.

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extent and trend of the variations may be determined and a more definite knowledge of what to expect in the future may be obtained. As every phase of the control of the weevil is based upon biological facts, life-history studies have a very direct economic bearing upon the boll-weevil problem.

During 1913, 1914, and 1915 the writer conducted a number of studies on the biology of the weevil at the Delta Boll Weevil Laboratory at Tallulah,[1] La. The present paper deals largely with the results of these two years' observations, but before detailing these it is probably best to review very briefly the times and conditions under which the similar studies have been conducted.

The earliest work was that at Victoria, Tex., in 1902 and 1903, the results being published early in 1904.[2] This was followed by similar investigations at the same place during 1904, and the results of these studies were included in a bulletin issued in 1905.[3]

During 1910 similar investigations were conducted at Tallulah, La., and the results were published in 1911.[4]

Then, in 1912, these studies and such others as had been made elsewhere were brought together in a large bulletin issued in 1912.[5]

During 1913 another series of studies was conducted at Victoria, Tex., to check those which had been made at the same place 10 years earlier. It was found that the weevils had made a number of important changes in their life history, principal among these being a much greater adaptability to plants other than cotton as food. The biology of the Arizona Thurberia weevil was also studied, and this variety was hybridized with the Texas cotton weevils. The results of these studies are included in three papers.[6]

In 1914 the life history and habits of the Arizona weevil were studied under natural conditions in the mountains near Tucson, Ariz. These studies are discussed in two papers.[7]

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[1] The writer wishes to acknowledge his indebtedness to Mr. E. K. Bynum for assistance in the work of 1915.

[2] Hunter, W. D., and Hinds, W. E. The Mexican Cotton Boll Weevil. U. S. Dept. Agr. Bur. Ent. Bul. 45, 116 p., 16 pl., 6 fig., 1904.

[3] Hunter, W. D., and Hinds, W. E. The Mexican Cotton Boll Weevil. U. S. Dept. Agr. Bur. Ent. Bul. 51, 181 p., 23 pl., 8 fig., 1905.

[4] Cushman, R. A. Studies in the biology of the boll weevil in the Mississippi Delta region of Louisiana. *In* Jour. Econ. Ent., v. 4, no. 5, 1911. p. 432–448.

[5] Hunter, W. D., and Pierce, W. D. Mexican Cotton Boll Weevil. U. S. Dept. Agr. Bur. Ent. Bul. 114, 188 p., 22 pl., 34 fig., 1912.

[6] Coad, B. R., and Pierce, W. D. Studies of the Arizona Thurberia weevil on cotton in Texas. Proc. Wash. Ent. Soc., v. 16, no. 1. p. 23–28. 1914.

Coad, B. R. Feeding habits of the boll weevil on plants other than cotton. U. S. Dept. Agr. Jour. Agr. Res., v. 2, no. 3, p. 235–245. 1914.

Coad, B. R. Recent studies of the Mexican Cotton Boll Weevil. U. S. Dept. Agr. Bul. 231, 34 p., 1 fig. 1915.

[7] Coad, B. R. Relation of the Arizona Wild Cotton Weevil to Cotton Planting in the Arid West. U. S. Dept. Agr. Bul. 233, 12 p., 4 pl. 1915.

Coad, B. R. Studies on the Biology of the Arizona Wild Cotton Weevil. U. S. Dept. Agr. Bul. 344, 23 p., 2 pl., 1 fig. 1916.

Thus it is seen that these studies embrace a wide range of time and conditions. In fact, the conditions of humidity, rainfall, temperature, altitude, soil, etc., include practically all extremes found in the cotton belt.

The various breeding series of 1914 and 1915 were conducted in a large insectary located at the Delta Laboratory, Delta, La. (fig. 1). This was provided with screen sides to furnish free air circulation, and the curtains were so arranged that the direct sunshine did not reach any of the breeding cages. Practically all of the breeding

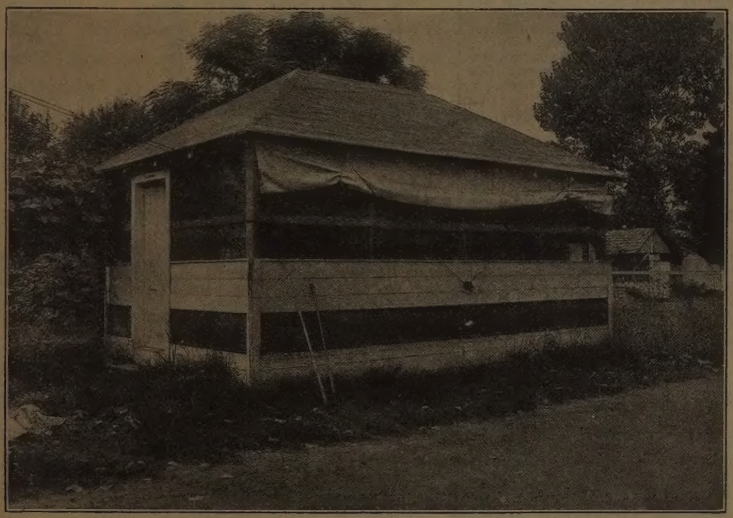

FIG. 1.—Insectary at the laboratory at Delta, La., for studies on the boll weevil. (Original.)

work was done in glass tumblers partially filled with moist sand and covered with a double thickness of cheesecloth.

LONGEVITY OF ADULT WEEVILS.

A considerable number of observations were made on the adult longevity on different foods. The data secured are separated by seasons.

SEASONS OF 1913 AND 1914.

Table I gives the observations made during the seasons of 1913 and 1914. The maximum record of longevity in 1914 was made by a first-generation female fed on cotton squares. This female emerged July 13 and died October 28, with a total life of 107 days. The maximum length of life of male weevils fed on cotton squares was 100 days; this individual emerging July 14 and dying October 22. The average longevity was 9.8 days on cotton leaves, 10.5 days on cotton bolls, and 46.3 days on cotton squares.

TABLE I.—*Duration of life of boll weevils. Observations of 1913–14.*

VARIETY GRANDIS WITHOUT NORMAL FOOD.

Season and period.	Food.	No. of weevils.	Weevil days.	Average longevity.	Maximum longevity.	Remarks.
1913.				*Days.*	*Days.*	
Sept. 24 to Oct 7	Hibiscus leaves	4	24	6.0	13	In paper bags on plants.
Sept. 24 to Oct. 10	Hibiscus bolls	4	25	6.3	16	Do.
Do	Hibiscus leaves, flowers, and bolls.	4	46	11.5	16	Do.
Sept. 24 to Oct. 9	Okra buds and fruit.	8	44	5.5	15	Do.
Sept. 24 to Oct. 12	Okra fruit	8	75	9.4	18	Do.
Sept. 24 to Oct. 8	Okra leaves	4	26	6.5	14	Do.
Sept. 24 to Oct. 10	Thurberia leaves	4	42	10.5	16	Do.
Sept. 24 to Oct. 4	Thurberia tips and buds.	4	34	8.5	10	Do.
Sept. 24 to Oct. 8	Thurberia squares.	4	29	7.3	14	Do.
Total longevity on malvaceous plants		44	345	7.8	18	

VARIETY GRANDIS WITH NORMAL FOOD.

1914.						
Aug. 6 to —	Cotton leaves	40	390	9.8	17	In glass tumblers.
July 15 to Aug. 1	Cotton bolls	20	210	10.5	16	Do.
June 3 to Oct. 28	Cotton squares	24	1,106	46	107	Females in glass tumblers.
June 13 to Oct. 28	do	24	1,118	46.6	100	Males in glass tumblers.
Total on normal food		108	2,824	26.1	107	

In the abnormal food studies the weevils lived an average of 6 days on Hibiscus leaves; 11.5 days on Hibiscus leaves, flowers, and fruit; 6.25 days on Hibiscus tips; 6.5 days on okra leaves; 9.4 days on okra fruit; 11 days on okra leaves, flowers, and fruit; 10.5 days on Thurberia leaves; 8.5 days on Thurberia tips and buds, and 7.3 days on Thurberia squares. These records are all low, probably due to the experimental methods, as the weevils were all placed upon the food in paper bags and later observations show that the method apparently causes an early death.

SEASON OF 1915.

The studies of 1915 compare the longevity of *grandis* weevils on moist sand with no food, on moist sand with okra and Hibiscus, on moist sand with different parts of the cotton, and also *thurberiae*, on moist sand with okra, with cotton bolls, and with cotton squares. The species of Hibiscus used were *H. militaris* and *H. moscheutos*. The results are given in Table II.

TABLE II.—*Duration of life of boll weevils. Observations of 1915.*

VARIETY GRANDIS WITHOUT NORMAL FOOD.

Date.	Substance provided.	Males.				Females.				Both sexes.		Notes on weevils.
		Number.	Weevil days.	Average longevity.	Maximum longevity.	Number.	Weevil days.	Average longevity.	Maximum longevity.	Maximum longevity.	Average longevity.	
				Days.	*Dys*			*Days.*	*Dys*	*Dys*	*Days.*	
June 9	No food	54	148	2.77	40	9	36	4.0	15	40	2.9	Hibernated weevils.
June 8	do	30	162	5.4	10	30	167	5.57	11	11	5.48	Collected in field. Hibernated.
June 29	do	20	40	2.0	6	20	48	2.4	5	6	2.20	Bred.
Sept. 8	do	12	27	2.25	3	12	33	2.75	3	3	2.50	Do.
Aug. 13	do	20	63	3.15	10	20	69	3.45	10	10	3.30	Do.
Total without food		136	440	3.24	40	91	353	3.88	15	40	3.49	
July 2	Young okra fruit	6	22	3.67	6	6	27	4.5	7	7	4.1	Bred from squares collected in field.
July 22	do	11	48	4.36	12	10	39	3.9	5	12	4.1	Do.
Aug. 13	Okra bloom and bud.	9	72	8.0	11	9	44	4.9	12	12	6.4	Bred from squares and fed on blooms until Aug. 7.
Aug. 2	Okra fruit	10	75	7.5	17	10	75	7.5	14	17	7.5	Collected in field.
Aug. 13	do	8	60	7.5	15	8	55	6.9	12	15	7.2	Bred weevils.
Aug. 24–27	do	14	123	8.8	18	14	164	11.7	20	20	10.3	Field collected.
Sept. 9	do	12	131	10.9	39	12	155	12.9	20	39	11.9	Do.
July 28	Hibiscus leaves	7	36			(1)	(1)	(1)		5	5.1	Collected in field. Not sexed. Not included in averages by sexes.
July 28	Hibiscus blooms	32	156							12	4.9	Do.
Aug. 25												
July 28	Hibiscus buds	4	18							5	4.5	Do.
Do	Hibiscus bolls	40	185							9	4.6	Do.
Aug. 18												
Total on malvaceous plants other than cotton		70	531	7.6	39	69	559	8.1	20	39	6.7	

VARIETY GRANDIS WITH NORMAL FOOD.

May 15	Cotton leaves	57	540	9.47	40	38	401	10.55	27	40	9.91	Hibernated.
June 12												
June 7	do	40	269	6.73	17	40	259	6.25	15	17	6.60	Bred.
June 21												
Aug. 9	do	38	258	6.80	17	39	332	8.51	32	32	7.66	Do.
Sept. 17												
Total on cotton leaves		135	1,067	7.9	40	117	992	8.48	32	40	8.17	
June 3	Cotton terminals	28	468	16.70	43	28	627	22.40	42	43	19.55	Field collected; probably hibernated.
June 9												
July 8	do	14	232	16.60	32	15	282	18.80	43	43	17.72	Bred.
Aug. 11	do	13	142	10.90	31	11	159	14.50	31	31	12.54	Do.
Sept. 7	do	20	259	13.00	31	19	187	9.84	45	45	11.44	Do.
Total on cotton terminals		75	1,101	14.68	43	73	1,255	17.19	45	45	15.92	
June 23	Cotton bolls	17	345	20.3	75	17	723	42.53	82	82	31.41	Do.
July 24												
June 20	Cotton squares	11	729	66.27	83	13	762	58.62	81	83	62.13	Bred. First generation.
June 21												
July 16	do	5	197	39.40	57	5	167	33.30	59	59	36.40	Bred. Second generation.
Aug. 9												
Total on cotton squares		16	926	57.88	83	18	929	51.61	81	83	54.56	
Total all *grandis* on cotton		243	3,439	14.15	83	225	3,899	17.33	81	83	15.68	

TABLE II.—*Duration of life of boll weevils. Observations of 1915*—Continued.

VARIETY THURBERIAE.

Date.	Substance provided.	Males.				Females.				Both sexes.		Notes on weevils.
		Number.	Weevil days.	Average longevity.	Maximum longevity.	Number.	Weevil days.	Average longevity.	Maximum longevity.	Maximum longevity.	Average longevity.	
				Days.	*Dys*			*Days.*	*Dys*	*Dys*	*Days.*	
Aug. 30....	Okra fruit.....	8	163	20.4	39	8	129	16.1	37	39	18.3	Removed from bolls collected in Arizona Mar. 1, 1915.
May 3.....	Cotton leaves...	11	647	58.82	97	10	616	61.6	78	97	60.14	From Thurberia bolls collected in Arizona Mar. 1, 1915.
July 15.....	.....do.....	5	350	70.0	78	....	.....	.....	.....	.....	.....	Do.
July 18..... Sept. 29....	First generation on squares.	16	1,136	71.0	104	19	1,269	66.8	89	104	68.7	Do.
July 17..... Sept. 22....	Second generation on squares	6	250	41.7	61	10	478	47.8	66	66	45.5	Do.
July 27..... Sept. 29....	On cotton bolls..	10	531	53.1	73	9	392	43.6	73	73	48.6	Do.
Total all *thurberiae* on cotton.....		48	2,914	60.71	104	48	2,755	57.40	89	104	59.05	

[1] Weevils not sexed.

The *grandis* males averaged 3.24 days with no food; 7.6 days on okra and Hibiscus; 7.9 days on cotton leaves; 14.68 days on cotton terminals; 20.3 days on cotton bolls, and 57.88 days on cotton squares. The average longevity of male *grandis* on parts of the cotton plant was 14.15 days.

The *thurberiae* males averaged 20.4 days on okra fruit; 62.3 days on cotton leaves, 53.1 days on cotton bolls, and 63 days on cotton squares. The average longevity of *thurberiae* males on parts of the cotton plant was 60.71 days.

The *grandis* females averaged 3.88 days with no food; 8.1 days on okra and Hibiscus; 8.48 days on cotton leaves; 17.19 days on cotton terminals; 42.53 days on cotton bolls, and 51.61 days on cotton squares. The average longevity of female *grandis* on parts of the cotton plants was 17.33 days.

The *thurberiae* females averaged 16.1 days on okra fruit; 61.6 days on cotton leaves; 43.6 days on cotton bolls, and 60.2 days on cotton squares. The average of female *thurberiae* on parts of the cotton plant was 57.4 days.

A comparison of the longevity of the two varieties on okra fruit, cotton leaves, cotton bolls, and cotton squares is shown in Table III.

TABLE III.—*Comparative longevity of Anthonomus grandis and A. g. thurberiae.*

Food.	Average longevity of grandis.	Average longevity of thurberiae.
	Days.	*Days.*
Okra fruit	5.4	18.3
Cotton leaves	8.17	62.04
Cotton bolls	31.41	48.6
Cotton squares	54.56	61.4
Average longevity irrespective of food	14.13	53.2

The longevity of *thurberiae* is greater in every instance than that of *grandis*, and the average longevity irrespective of food is nearly forty days greater for the *thurberiae* weevils.

The maximum longevity obtained in the 1915 experiments is 104 days, this record being made by a male *thurberiae* feeding on cotton squares.

The maximum longevity with no food was 40 days; on okra and Hibiscus 39 days; on cotton leaves 97 days; on cotton bolls 82 days; on cotton terminals 45 days, and on cotton squares 104 days.

The comparison of the longevity by sexes is shown in Table IV. Here it is seen that in *grandis* the females exceeded the males on every food except cotton squares while in the *thurberiae* variety the males lived the longer in each case. The observations relating to *grandis* are in accord with the earlier records, which stated that the females exhibited greater hardihood on abnormal foods, but that the relation was reversed with normal food.

TABLE IV.—*Comparison of longevity of the boll weevil by sexes. Observations of 1915.*

VARIETY GRANDIS.

Food.	Males.			Females.		
	Number.	Weevil days.	Longevity.	Number.	Weevil days.	Longevity.
			Days.			*Days.*
None	136	440	3.24	91	353	3.88
Malvaceous plants	70	531	7.60	69	559	8.10
Cotton leaves	135	1,067	7.90	117	992	8.48
Cotton terminals	75	1,101	14.68	73	1,255	17.19
Cotton bolls	17	345	20.30	17	723	42.53
Cotton squares	16	926	57.88	18	929	51.61
Total grandis	449	4,410	9.82	385	4,811	12.50

VARIETY THURBERIAE.

Okra	8	163	20.4	8	129	16.1
Cotton leaves	16	997	62.3	10	616	61.6
Cotton bolls	10	531	53.1	9	392	43.6
Cotton squares	22	1,386	63.0	29	1,747	60.2
Total thurberiae	56	3,077	54.9	56	2,884	51.5

The longevity records of 1914 and 1915 added to those previously obtained show that 6,119 weevils fed on water averaged 9.9 days; 308 weevils fed on cotton averaged 8.6 days; 542 weevils fed on malvaceous plants averaged 9 days; 146 weevils fed on cotton foliage averaged 24.3 days and 534 weevils fed on cotton squares averaged 54.2 days. The most interesting features of the recent investigations on longevity are the greater adaptability of *grandis* for abnormal food plants and the very great longevity of *thurberiae* on any food. In view of this trend displayed by *grandis* and the adaptations which have already been made by *thurberiae* it seems reasonable to expect that *grandis* will continue to acquire greater hardihood when offered only abnormal foods.

Field cage studies.—For comparison with the laboratory tests of longevity, several experiments were conducted in field cages. Large cages covered with 16-mesh screen were placed over growing cotton plants and the first hibernated weevils found in the field in the spring were placed in them. Six cages in all were started on dates ranging from May 12 to June 19. These cages were watched for the cessation of weevil injury to the plants. However, the greater part of the new weevils died almost immediately after installation and the latest date on which a weevil was observed alive was July 22. It is apparent that the conditions are very abnormal in these cages, owing to the effect upon the light, temperature, humidity, etc. In fact, the plants themselves make a very abnormal growth when caged. A few observations were made during this period to determine the difference in temperature inside and outside these cages and they indicated a slightly higher daily maximum inside the cage than outside. The observations generally indicate that the conditions are very abnormal in these cages and that there is serious danger of error in drawing conclusions based only on such observations.

FOOD PLANTS OF THE WEEVIL.

During the early investigations on the boll weevil many attempts were made to find the weevils feeding or breeding on any plant other than cotton but they were uniformly unsuccessful. In fact, the first record of a cotton boll weevil feeding in nature on any plant other than cotton was in 1913, when one individual was found at Victoria, Tex., eating a bloom of *Hibiscus syriacus*. Observations since that time have shown a number of cases of the weevils feeding on plants closely related to cotton. The most important of these seem to be okra and the various wild species of Hibiscus.

Okra.—Okra is found very closely associated with cotton in many parts of the cotton belt. In fact, the plants are usually scattered through the cotton fields or are in the small garden patches adjoining cotton. Consequently there is a very good opportunity for the weevils to attack this plant.

During 1915 a number of okra plants were examined for weevils with the following results: On September 10 a few plants were examined at Inverness, Miss. Three open blooms were found and five boll weevils were in them, one blossom containing three. On September 29 and 30 a total of 122 okra plants were examined between Tallulah and Mound, La. These plants had 114 open blooms but the only weevil found was on the fruit. This individual was watched for about five minutes and in this time it made no attempt to feed.

Several additional records of the weevil on okra were made during the season on the plants growing at the laboratory and also in the field. Nearly all of these weevils were in the blooms and, where feeding was found, it was confined to the petals and stamens. No evidence of breeding in the buds or fruit in nature was secured.

Laboratory studies were also made upon the feeding in captivity and the possibility of breeding in the buds or fruit of okra. Sixty-nine pairs of weevils were mated on okra buds and small fruit and given only this food until death. Eleven eggs were deposited normally and three externally, but the larvæ failed to survive on this food. The weevils fed quite freely on these foods and also on okra blooms. In fact, the greatest amount of feeding was on the immature boll at the base of the bloom. Occasionally this small boll would be riddled with feeding punctures.

One cage test was conducted in the attempt to produce somewhat the conditions which would exist if cotton planting were suddenly stopped and only okra left for food. For this purpose a large cage was erected in the laboratory yard over a row of growing cotton plants and a row of okra (fig. 2). On August 27, 100 weevils, 50 males and 50 females, collected from cotton in the field were placed in the cage. Daily observations on the relative number of weevils on cotton and okra were made for 10 days. During this time 294 observations were made of weevils on cotton, while they were found on the okra only 16 times.

On September 6 the cotton plants were carefully removed from the cage and only the growing okra left for the weevils. On September 7 six weevils were feeding on the okra and on September 8 seven weevils were located, one feeding on a leaf and three feeding on the bloom. On September 9 three examinations were made and from 3 to 6 weevils, one of which was feeding on a bloom, were found on the okra each time. After that date the weevils were found on the okra only at irregular intervals and on September 19 no live weevils were found in the cage. At this time all the okra fruit was closely examined for egg punctures but none were found. However, to make sure that none were overlooked, all the fruit was placed on moist sand in a breeding cage and saved for some time, after which the contents were examined but no signs of larval work were found.

Hibiscus.—Two species of Hibiscus are found commonly around Tallulah, La., viz, *militaris* and *moscheutos*. One plant of *Hibiscus lasiocarpus* was found but does not seem to be common. *H. militaris* and *H. moscheutos* are found principally in low, moist places such as

FIG. 2.—One of the cages containing cotton and okra plants, Delta, La. Photographed at time of introduction of boll weevils. (Original.)

the bayou banks, in roadside ditches, and in swamp land, where they grow to considerable size and fruit throughout most of the summer. No weevils were found on these, but practically all of the plants noted were some distance from cotton.

One plant of *H. militaris* was transplanted to the laboratory yard and a number of adult weevils were found feeding in the blooms during the season. The feeding was apparently confined to the stamens and petals.

In addition to these field observations laboratory studies were conducted in an attempt to rear weevils in Hibiscus buds as was done at Victoria, Tex., in 1913. In connection with these attempts, some interesting feeding records were secured.

Thirty-two weevils that were fed with Hibiscus blooms only were noted to feed freely on the petals, and four cases of feeding on the immature boll at the base of the bloom were also noted.

Four weevils were fed on Hibiscus buds alone; they fed sparingly but deposited no eggs.

In an experiment where 127 weevils were placed in breeding jars with fresh Hibiscus fruits, considerable feeding was noted and 5 eggs were deposited, 4 externally and 1 normally. The eggs deposited externally were placed in incisions in the Hibiscus bolls and saved on moist sand, but later examinations of these bolls showed no sign of larval work.

Other plants.—On September 4 two weevils were found on the foliage of cultivated zinnia growing at the laboratory.

Early in the spring hibernated weevils were confined in breeding cages with blooms of violet, peach, pear, and osage-orange and left until death, but no sign of feeding was found.

While the weevils were not found breeding on the various malvaceous plants and the laboratory attempt to get them to do so gave negative results, the increasing adaptability of the weevil to them as food is quite evident.

FEEDING HABITS ON COTTON LEAVES AND TERMINALS.

In connection with the studies on the longevity of the weevils on cotton leaves and terminals as already reported, a number of interesting observations were made on the character and extent of the feeding. Normally the weevils apparently never feed upon the leaves, and the feeding on the terminals is largely limited to the time before the first squares appear in the spring.

Cotton leaves.—Eighty pairs of weevils were placed in breeding cages on cotton leaves during the season and observations were made on a total of 747 weevil days. During this time the weevils fed 128 days on the leaf tissue alone, 30 days on the stem alone, and 211 days on both stem and leaf tissue; in other words, 34.7 per cent of the feeding was on leaf tissue, 8.1 per cent on stem, and 57.2 per cent on both leaf and stem. The feeding of *grandis* on the leaf tissue usually consisted of a limited number of small punctures but that of *thurberiæ* was much more voracious. The latter would frequently devour almost the entire leaf in a day.

Cotton terminals.—Seventy-five pairs of weevils were fed on cotton terminals during the season and observations were made on a total of 1,920 weevil days. Feeding was observed on 1,226 weevil days. On 616 days the weevils fed on the stem alone, or 50.2 per cent of all feeding was on this part. On 602 days, or 49.1 per cent of the feeding days, the feeding was on both the stem and bud, while the bud alone was attacked on only 8 days, or 0.7 per cent of the feeding days.

The preference of the weevil for the stem in these two series was quite marked. This may be due to the mechanical stimulus presented by the shape of the stem which will allow punctures more or less like those made in the squares and bolls.

TABLE V.—*Relative proportions of the sexes of boll weevils. Observations of 1915.*

Variety and description of material.	Male.		Female.	
	Number.	Per cent.	Number.	Per cent.
Grandis:				
Hibernated weevils	439	55.00	360	45.00
Bred weevils	1,591	51.59	1,493	48.41
Total *grandis*	2,030	52.28	1,853	47.72
Thurberiae.				
Bred from cotton squares	71	55.98	56	44.02
Bred from cotton bolls	4	40.00	6	60.00
Total *thurberiae*	75	54.74	62	45.26
Hybrids:				
Male *thurberiae* and female *grandis*	52	50.49	51	49.51
Male *grandis* and female *thurberiae*	50	44.25	63	55.75
Total hybrids	102	47.22	114	52.78
Total and average of all weevils	2,207	52.10	2,029	47.90

SEX OF ADULTS.

A considerable number of the weevils handled during the season were sexed, and Table V shows the ratio of the sexes.

Of the hibernated *grandis* material, 439 were males and 360 were females, or 55 per cent males and 45 per cent females. Of the *thurberiae* weevils extracted from Thurberia bolls, 54.74 per cent were males and 45.26 per cent were females. Of the 214 sexed hybrid weevils bred during the season 47.22 per cent were males and 52.78 per cent were females. These last figures are in accordance with the observations in 1913 that there was a larger percentage of females in variety *thurberiae* and the hybrids than in the variety *grandis*.

PERIOD FROM EMERGENCE TO OVIPOSITION.

In the series of typical *grandis* females the period from emergence to oviposition when fed on squares varied from 2 to 16 days with an average of 6.6 days. Fourteen females emerging in late June averaged 5.9 days from emergence to oviposition and 5 females emerging in late July and early August averaged 8.8 days from emergence to oviposition. Thus it is shown that temperature has a

direct influence on the length of time elapsing between emergence and oviposition. Ten typical *thurberiae* emerging in late July and early August averaged 6.8 days from emergence to oviposition. These periods ranged from 3 to 10 days. *Grandis* females in Texas in 1913 averaged 6.1 days and *thurberiae* females 4 days. At Tallulah in 1910, 34 females averaged 6.35 days before oviposition.

PERIOD FROM FIRST FEEDING ON SQUARES TO OVIPOSITION.

The period from first feeding on squares after emergence from hibernation to egg deposition was observed only with typical *thurberiae* females and with crosses of *grandis* and *thurberiae*. With typical *thurberiae* emerging in June it ranged from 10 to 18 days with an average of 13.3 days, while male *thurberiae* mated with female *grandis* varied from 3 to 10 days with an average of 7 days. With female *thurberiae* mated with male *grandis* the period varied from 9 to 18 days with an average of 12 days. Female *thurberiae* mated with male *grandis* in Texas in 1913 averaged 13.5 days in May and June and 3 days in early September, while hibernated *grandis* males averaged 4.2 days in early May. These records seem to indicate that the period is several days longer for *thurberiae* than for *grandis*.

FECUNDITY.

In connection with the various breeding series conducted during 1915 a considerable amount of information on the fecundity of the females of various types was secured.

Fecundity of hibernated grandis females.—Questions have frequently been raised concerning whether or not it is necessary for a female to be fertilized in the fall to pass the winter safely and also as to whether or not it is necessary for the females to be fertilized in the spring before deposition can start. Two series of females were tested to determine their exact condition upon emergence from hibernation in the spring. One series consisted of isolated females which were collected immediately after emergence started and which were not offered an opportunity for copulation after that time, while in the other series males were left with the females throughout their life. Of course there is a possibility that some of these females may have been fertilized during the time between emergence and collection but this is very slight as the emergence had just started and they had had very little time in which to copulate. Earlier studies have shown that either square or boll food is necessary before the female can be successfully fertilized and there were extremely few squares present in the field before the time of collection of these weevils, consequently it seems safe to assume that at least the majority of these females had not been fertilized in the spring. Both series were given cotton squares for food and oviposition.

TABLE VI.—*Fecundity of hibernated females of Anthonomus grandis kept with males constantly during life.*

Activity of individual females.												Progeny produced by individual females.								
Date female collected.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.					Date male dead.	Date female dead.	Period last egg to death of female.	Male weevils bred.	Male weevil days.	Male developmental period.	Female weevils bred.	Female weevil days.	Female developmental period.	Total weevils bred.	Total weevil days.	Period both sexes.	Per centage eggs producing adults.
				Normally.	Externally.	Total.	Average per day.	Maximum per day.													
			Dys.								*Days.*			*Days.*			*Days.*			*Days.*	
May 26	June 3	Aug. 3	62	123	0	123	2.0	9	July 4	Aug. 3	0	9	121	13.4	13	176	13.5	22	297	13.5	17.89
Do..	June 1	June 9	9	5	0	5	6	4	July 14	June 9	0	1	14	14.0	1	14	14	2	28	14	40.00
Do..	June 2	June 26	25	63	0	63	2.5	5	July 14	July 5	9	2	29	14.5	7	105	15	9	134	14.9	14.29
Do..	June 6	June 29	24	26	0	26	1.1	4	July 24[1]	June 30	1	1	13	13	1	13	13	2	26	13	7.69
Do..	June 1	July 5	35	40	0	40	1.1	6	July 16	July 9	4	3	48	16	2	32	16	5	80	16	12.50
Do..	June 6	June 28	23	41	0	41	1.8	4	July 7	July 2	4	1	14	14	3	43	14.3	4	57	14.25	9.76
Do..	June 2	June 18	17	19	0	19	1.1	3	July 3[1]	June 22	4	0	0	.....	2	29	14.5	2	29	14.5	10.53
Do..	June 3	July 19	47	107	0	107	2.3	7	July 14	July 22	3	11	163	14.8	10	140	14	21	303	14.4	19.63
Do..	June 2	July 10	39	93	0	93	2.4	9	June 15	July 13	3	8	119	14.9	2	27	14.5	10	146	14.6	10.75
Do..	June 22	July 12	21	1	1	2	.1	1	June 8	July 24	12	1	17	17	0	0	.....	1	17	17	50.00
Do..	June 25	July 8	34	108	0	108	3.2	6	July 17	July 10	2	5	71	14.2	6	83	13.8	11	154	14	10.19
Do..	June 4	July 31	58	98	0	98	1.7	7	July 26	Aug. 2	2	5	72	14.4	12	168	14	17	240	14.1	17.35
Do..	June 2	June 23	22	19	0	19	.9	3	June 3[1]	June 28	5	3	44	14.7	1	12	12	4	56	14	21.05
June 16	June 17	July 31	45	105	0	105	2.3	7	Sept. 3	Aug. 6	6	5	78	15.6	3	44	14.7	8	122	15.25	7.62
June 17	June 20	Aug. 23	65	32	4	36	.6	5	June 21	Sept. 5	13	5	69	13.8	3	39	13	8	108	13.5	22.22
Do..	June 18	July 18	31	73	0	73	2.4	7	July 6[1]	July 24	6	6	81	13.5	4	56	14	10	137	13.7	13.70
Do..	June 18	July 14	27	150	1	151	5.6	12	Aug. 31	July 17	3	8	119	14.9	3	39	13	11	158	14.4	7.28
Do..	June 20	June 20	1	1	1	2	1	1	June 27	June 21	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Do..	June 18	Aug. 4	48	128	1	129	2.7	8	Aug. 27	Aug. 8	4	10	132	13.2	12	155	12.9	22	287	13	17.05
Do..	June 19	Aug. 5	48	156	1	157	3.3	7	June 30[1]	Aug. 9	4	13	179	13.8	20	268	13.4	33	447	13.5	21.02
Total			681	1,388	9	1,397	.....	115	.....	.....	86	97	1,383	.....	105	1,443	.....	202	2,826	.....	.....
Average			34.5	69.4	.45	69.85	2.05	5.75	.....	.....	4	.....	.....	14.3	.....	.....	13.7	.....	.....	14.0	14.46
Maximum			65	156	4	157	5.6	12	.....	.....	13	13	.....	17.0	20	.....	16.0	33	.....	17.0	50.0
Minimum			1	1	.....	2	.6	.....	.....	.....	1	.....	.....	13.0	0	.....	12.0	0	.....	13.0	0

[1] Escaped.

Latest date of deposition, August 23. Average date of cessation of oviposition, July 13.

TABLE VII.—*Fecundity of hibernated females of Anthonomus grandis not fertilized in spring.*

Activity of individual females.										Progeny produced by individual females.									
Date female collected.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.					Date female dead.	Period last egg to death of female.	Male weevils bred.	Male weevil days.	Male developmental period.	Female weevils bred.	Female weevil days.	Female developmental period.	Total weevils bred.	Total weevil days.	Period both sexes.	Percentage eggs producing adults.
				Normally.	Externally.	Total.	Average per day.	Maximum per day.												
										Days.			*Days.*			*Days.*			*Days.*	
June 1	June 2	June 29	28	32	0	32	1.2	3	June 30[1]	.....	6	87	14.5	3	41	13.7	9	128	14.2	28.13
Do	do	July 10	39	26	1	27	.7	4	July 14	4	2	28	14	0	0	0	2	28	14	7.40
Do	June 7	Aug. 22	77	49	9	58	.8	5	Aug. 23	1	5	69	13.8	6	81	13.5	11	150	13.6	18.96
Do	June 9	July 19	41	114	0	114	2.8	6	July 21	2	8	107	13.4	11	150	13.6	19	284	15.0	16.67
Do	June 16	July 21	36	14	1	15	.4	2	July 22	1	0	0	0	1	12	12	1	12	12	6.67
Do	June 9	June 28	20	2	2	4	.2	2	June 30[1]	.....	0	0	0	1	17	17	1	17	17	25.00
Do	June 12	July 8	27	4	4	8	.3	2	July 14	6										
Do	June 9	July 19	41	10	8	18	.4	3	July 29	10	1	11	11	0	0	0	1	11	11	5.56
Do	June 7	June 30	24	8	5	13	.5	2	July 13	13	1	14	14	0	0	0	1	14	14	7.69
Do	June 7	Aug. 4	59	6	11	17	.3	2	Aug. 5	1	1	16	16	1	16	16	2	32	16	11.76
Do	June 9	July 4	26	14	0	14	.5	3	July 15	11	1	15	15	2	29	14.5	3	44	14.7	21.43
Do	June 15	July 30	46	4	2	6	.1	2	Aug. 5	6										
Do	June 15	Aug. 17	64	9	30	39	.6	3	Aug. 23	6	1	17	17	2	27	13.5	3	44	13.7	7.69
Do	June 7	July 17	41	127	2	129	3.1	7	July 26	9	8	116	14.5	14	184	13.1	22	300	13.6	13.05
June 2	June 11	July 15	35	39	1	40	.9	4	July 17	2	5	66	13.2	3	43	14.3	8	109	13.6	20.00
Do	June 26	Aug. 13	49	12	9	21	.4	2	Aug. 22	9										
Do	June 19	July 3	15	1	2	3	.2	1	July 12	9										
Do	June 10	Aug. 23	75	31	16	47	.6	5	Aug. 25	2	3	40	13.3	1	16	16	4	56	14.0	8.51
Do	June 14	July 17	34	54	0	54	1.6	5	July 20	3	6	78	13	3	39	13	9	117	13.0	16.67
Do	June 9	June 26	18	35	1	36	2.0	5	June 26	0	3	48	16	3	42	14	6	90	15	16.67
Do	June 10	Aug. 20	72	85	13	98	1.4	6	Aug. 25	5	6	78	13	9	129	14.3	15	207	13.8	15.31
Do	June 15	July 22	38	59	6	65	1.7	5	July 24	2	13	179	13.8	10	134	13.4	23	303	13.2	35.38
Do	June 10	July 24	45	72	2	74	1.6	5	July 31	7	8	111	13.9	7	96	13.7	15	207	13.8	20.27
Do	June 12	July 3	22	43	0	43	2.0	3	July 9	6	5	73	14.6	2	28	14	7	101	14.4	16.28
Do	June 10	July 7	28	57	0	57	2.0	5	July 11	4	8	111	13.9	8	109	13.6	16	220	13.75	28.07
Total			1,000	907	125	1,032	.....	92	.....	122	91	1,264	.....	87	1,193	.....	178	2,457	.....	.....
Average			40	36.28	5	41.28	1.03	3.68	.....	5.3	.....	.....	13.9	.....	.....	13.7	.....	.....	13.8	17.25
Maximum			77	127	30	129	3.1	7	.....	13	13	.....	17.0	14	.....	17.0	23	.....	17.0	35.38
Minimum			15	1	0	3	.1	1	.....	0	0	.....	11.0	0	.....	12.0	0	.....	11.0	.....

[1] Escaped,

Latest date of deposition, August 23. Average date of cessation of oviposition, July 20.

From the results of these two series, shown in Tables VI and VII, it develops that all of the 25 isolated females deposited eggs, although 4 of them deposited less than 10 eggs each, whereas of the 20 fertilized females only 3 individuals deposited less than 10 eggs. The average oviposition period was 34.5 days for the isolated females and 40 days for females with the males. The average eggs for the isolated females was 41.2 with a maximum of 129, while for the females with males the average was 69.8 with a maximum of 157. However, it is seen that the isolated females averaged 5 eggs deposited externally while the females with males averaged only 0.45. Earlier studies have shown that practically all eggs deposited externally are infertile, which would indicate a lack of fertility on the part of isolated females. The average eggs per day for the isolated females ranged from 0.1 to 3.1 with a general average of 1.03, whereas for the females with males it ranged from 0.6 to 5.6 with an average of 2.05 eggs, thus proving the greater fecundity of the females with males.

The latest date of cessation of oviposition, August 23, was the same in both series, but the average date for the isolated females was 7 days later than that of the females with males. All eggs secured in both series were retained and as many adults as possible were reared. It is seen that 17.25 per cent of the eggs from the isolated females produced adults, while 14.46 per cent of those from the females with males produced adults. However, the eggs from every female in the series with males produced some adults, while those from 4 females in the isolated series failed to produce any.

From these observations it seems quite evident that at least a very high percentage of the females emerging in the spring are more or less fertile, but that their fecundity is considerably increased by later copulations.

Fecundity of first-generation grandis females.—The weevils used in this series were the first weevils bred during the season of 1915, the earliest emerging June 20. Thirteen pairs were mated and placed with cotton squares. (Table VIII.)

TABLE VIII.—*Fecundity of first-generation females of Anthonomus grandis on cotton squares.*

Date female emerged.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
June 20	June 26	Sept. 7	74	198	2.5	8
Do	...do	Aug. 4	40	197	4.93	10
Do	June 29	Aug. 29	62	91	1.5	7
Do	June 28	July 28	31	57	1.8	5
June 21	June 26	July 20	25	89	3.7	9
Do	...do	July 14	19	66	3.5	11
Do	June 23	Aug. 15	54	191	3.5	8
Do	June 27	Aug. 25	66	160	2.4	8
Do	...do	Aug. 27	62	142	2.3	12
Do	June 28	Aug. 31	65	107	1.6	6
Do	June 26	Aug. 26	62	111	1.8	6
Do	...do	July 28	33	110	3.3	7
Do	...do	Aug. 23	59	204	3.5	10
Total			650	1,723		
Average			50	132.5	2.7	
Maximum			74	204	4.9	12
Minimum			19	57	1.5	5

The total number of eggs deposited by each female ranged from 57 to 204 with an average of 132.5. The average number of eggs per female per day was 2.7 and the maximum was 12. The oviposition period varied from 19 to 74 days with an average of 50 days.

Fecundity of second generation grandis females.—Five pairs of weevils emerging from the first generation series were mated and placed with cotton squares during the last of July and the first of August (Table IX.)

TABLE IX.—*Fecundity of second-generation females of Anthonomus grandis on cotton squares.*

Date female emerged.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
July 16	July 23	July 29	7	13	1.9	4
Aug. 13	Aug. 18	Sept. 4	18	42	2.3	6
July 16	July 27	...do	40	93	2.3	8
July 29	Aug. 2	Sept. 5	35	175	5.0	10
Aug. 9	Aug. 17	Aug. 28	13	24	1.6	6
Total			113	347		
Average			22.6	69.4	3.1	
Maximum			40	175	5.0	10
Minimum			7	13	1.6	4

The total number of eggs per female ranged from 13 to 175 with an average of 69.4. The number of eggs per female per day varied from 1.6 to 5.0 and the maximum number was 10. The oviposition period ranged from 7 to 40 days with an average of 22.6 days.

Fecundity of hibernated thurberiae females.—The weevils used in this series were hibernated individuals extracted from cells in Thurberia bolls collected in Arizona on March 1, 1915. Nineteen pairs were mated on cotton squares on June 18. (Table X.)

TABLE X.—*Fecundity of hibernated females of Anthonomus grandis thurberiae on cotton squares.*

Date installed.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
June 18	June 29	Aug. 8	41	46	1.1	4
Do	June 28	Aug. 2	36	82	2.3	6
Do	July 5	July 25	21	9	.4	3
Do	July 1	Aug. 7	38	109	2.9	7
Do	...do...	Sept. 4	66	90	1.4	4
Do	June 29	Aug. 16	49	49	1.0	4
Do	...do...	July 17	19	26	1.4	5
Do	June 28	Aug. 25	59	76	1.3	5
Do	July 3	Aug. 18	47	47	1.0	4
Do	...do...	July 29	27	54	2.0	4
Do	July 1	July 20	20	5	.25	2
Do	June 28	Sept. 9	74	58	.8	5
Do	July 1	Aug. 3	34	54	1.6	6
Do	July 2	Aug. 2	32	62	1.9	5
Do	July 1	Aug. 20	51	45	.9	5
Do	...do...	Aug. 27	58	57	1.0	5
Do	July 2	Aug. 14	54	69	1.3	6
Do	July 5	Aug. 2	29	73	2.5	6
Do	June 29	Aug. 6	39	57	1.5	4
Total			791	1,068		
Average			41.79	56.2	1.3	
Maximum			74.00	109	2.9	7
Minimum			19.00	5	.25	

The total eggs per female ranged from 5 to 109, with an average of 56.2. The average eggs per female per day was 1.3, while the maximum was 7. The oviposition period varied from 19 to 74 days, with an average of 41.79 days.

Fecundity of first-generation thurberiae females.—Ten pairs of the progeny of the hibernated *thurberiae* reared in cotton squares were mated on cotton squares. (Table XI.)

TABLE XI.—*Fecundity of first-generation females of Anthonomus grandis thurberiae on cotton squares.*

Date installed.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
July 17	July 24	Sept. 1	40	72	1.8	5
July 18	July 28	Aug. 24	28	37	1.3	4
Do	July 24	Sept. 20	59	39	.7	5
Do	July 25	Sept. 9	47	15	.3	3
Do	July 25	Aug. 28	35	12	.3	3
Aug. 4	Aug. 10	Sept. 5	27	27	1.0	5
July 19	July 29	Sept. 22	25	11	.8	2
July 22	July 25	Aug. 3	10	7	.7	2
July 24	Aug. 3	Aug. 26	24	6	.3	2
Aug. 4	Aug. 7	Aug. 25	19	18	1.0	4
Total			314	244		
Average			31.4	24.4	1.4	
Maximum			59	72	1.8	5
Minimum			10	6	.3	

The number of eggs per female ranged from 6 to 72, with an average of 24.4, while the average per female per day was 1.4 and the maximum per day was 5. The oviposition period ranged from 10 to 59 days, with an average of 31.4 days.

From this and the preceding series the greatly reduced fecundity of *thurberiae* under the artificial condition prevailing at the Tallulah laboratory is quite evident.

Fecundity of bred grandis females mated with male thurberiae.—Late in June 12 newly emerged female *grandis* of the first generation were mated with hibernated male *thurberiae* on cotton squares. (Table XII.)

TABLE XII.—*Fecundity of bred females of Anthonomus grandis mated with male A. g. thurberiae on cotton squares.*

Date installed.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
June 22	June 29	July 7	9	35	3.9	7
July 27	Aug. 2	Sept. 8	38	134	3.5	9
June 22	July 2	July 28	27	124	4.6	8
July 27	Aug. 4	Aug. 31	28	19	.7	2
June 22	June 28	July 10	13	29	2.2	7
July 29[1]	Aug. 1	Aug. 28	28	100	3.6	8
June 22	June 28	July 7	10	31	3.1	5
July 27	Aug. 5	Sept. 10	37	87	2.4	6
June 22	June 30	July 13	14	32	2.3	5
July 27	Aug. 3	Sept. 19	48	87	1.8	6
June 22	June 28	July 3	6	13	2.2	6
Do	July 1	Aug. 7	38	113	3.0	7
Do	June 28	Aug. 10	44	166	3.8	15
Total			312	870		
Average			26	72.5	2.8	
Maximum			48	166	4.6	15
Minimum			6	13	.7	

[1] A complete record was not secured from this female owing to its escape on August 30, and consequently the figures are not included in the totals and averages.

The total eggs per female varied from 13 to 166, with an average of 72.5, and the average per female per day was 2.8. The oviposition period ranged from 6 to 48 days, with an average of 26 days.

The hybrid progeny reared from these eggs were mated on cotton squares and laid fertile eggs.

Fecundity of female thurberiae mated with male grandis.—In June 18 hibernated females of the variety *thurberiae* were mated with an equal number of male *grandis* on cotton squares. The detailed results are shown in Table XIII.

TABLE XIII.—*Fecundity of hibernated female Anthonomus grandis thurberiae mated with male A. grandis on cotton squares.*

Date installed.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited.		
				Total.	Per day.	Maximum per day.
			Days.			
June 19	July 3	Sept. 7	67	31	0.5	3
Do	June 28	Sept. 3	68	77	1.1	4
Do	July 2	Aug. 13	43	133	3.1	8
Do	June 28	Aug. 6	40	48	1.2	5
Do	June 29	Sept. 2	66	72	1.1	4
Do	...do	Aug. 3	36	65	1.8	5
Do	July 3	Aug. 4	33	47	1.4	4
Do	July 5	July 24	20	31	1.5	3
Do	June 30	Aug. 22	54	59	1.1	4
Do	July 7	Aug. 21	45	40	.9	4
Do	July 5	Aug. 20	47	51	1.1	4
Do	July 2	July 28	27	30	1.1	4
Do	June 28	Aug. 2	36	77	2.2	6
Do	...do	Aug. 11	45	71	1.6	5
Do	July 1	Aug. 24	55	47	.9	5
Do	July 4	Aug. 4	32	32	1.0	2
Do	June 28	Aug. 2	36	35	1.0	4
Do	...do	July 24	27	24	.9	4
Total			777	970		
Average			43.2	54	1.3	
Maximum			68	133	3.1	8
Minimum			20	24	.5	

The total eggs per female ranged from 24 to 133, with an average of 54, and the general average per day was 1.3 eggs. The oviposition period varied from 20 to 68 days and averaged 43.2 days.

The progeny of this cross were also mated and produced fertile eggs.

Fecundity of bred grandis females on cotton bolls.—Eighteen pairs of bred *grandis* weevils were placed with cotton bolls and furnished only this food until death. Seven of these females died without depositing a single egg. The activities of the remaining 11 are shown in Table XIV.

TABLE XIV.—*Fecundity of bred females of Anthonomus grandis on cotton bolls.*

Date installed.	Oviposition.			Total eggs.	Eggs per day.	
	Started.	Ended.	Period.		Average.	Maximum.
			Days.			
July 9	July 18	Aug. 3	17	5	0.3	1
Do	July 19	July 25	6	3	.5	2
Do	July 14	Sept. 7	45	17	.4	2
Do	July 28	Aug. 22	26	13	.5	2
Do	July 16	Sept. 5	52	17	.3	2
Do	July 12	Sept. 10	61	24	.4	3
July 16	July 23	Aug. 7	16	5	.3	3
July 24	Aug. 7	Aug. 17	11	2	.2	1
Do	Aug. 6	Sept. 16	42	5	.01	2
Do	July 30	Aug. 17	19	2	.01	1
Do	July 26	Sept. 16	22	8	.4	2
Total			317	101		
Average			29	9	.3	
Maximum			61	24	.5	3
Minimum			6	2	.01	

The total eggs per female varied from 2 to 24, with an average of only 9, and the average per day was only 0.3. The oviposition period ranged from 6 to 61 days, with an average of 29 days.

These results indicate the great difficulty with which oviposition is performed when only bolls are offered for food, but at least a large percentage of the eggs deposited were fertile, as 20 adults were reared from them.

Fecundity of hibernated thurberiae females on cotton bolls.—Nine pairs of *thurberiae* weevils were extracted from their hibernation cells in Thurberia bolls on July 27 and placed with cotton bolls at once. They were offered only this food until death. The results are given in Table XV.

TABLE XV.—*Fecundity of hibernated Anthonomus grandis thurberiae on cotton bolls.*

Date installed.	Date oviposition began.	Date oviposition ended.	Oviposition period.	Eggs deposited—			Maximum per day.
				Normally.	Externally.	Total.	
			Days.				
July 27	Aug. 11	Sept. 18	39	1	62	63	7
Do	July 28	Sept. 5	41	1	1	2	1
Do	Aug. 15	Aug. 28	14	1	1	2	1
Do[1]	July 28	Aug. 20	24	6	8	14	3
July 27	Aug. 4	Aug. 18	15	2	5	7	2
Do	July 28	Sept. 24	59	1	2	3	.....
Do	Aug. 4	Aug. 16	13	4	1	5	2
Do	Aug. 18	Sept. 9	23	1	1	2	1
Do	July 30	July 30	1	.....	1	1	1
Total	.....	.....	204	11	74	85	.....
Average	.....	.....	25.5	1.3	9.3	10.6	.....
Maximum	.....	.....	59	4	62	63	7
Minimum	.....	.....	1	.....	1	1	.....

[1] This female escaped Aug. 20, and consequently is not included in the averages.

One of these females escaped, and consequently only eight are considered in the averages. These eight deposited a total of only 85 eggs, and 74, or 89.4 per cent of these were deposited externally. It is striking that every female that deposited any eggs laid one or more externally. This is positive evidence of the unsuitability of bolls as food for these weevils.

The average total eggs per female was 10.6 and the average number deposited normally was only 1.3. These eggs were fertile, however, as several adults were reared from them.

Fecundity of grandis females on cotton bolls and squares on alternate days.—In addition to the foregoing studies on the effect of cotton bolls on the deposition of females another series was conducted in which each female was offered squares and bolls on alternate days. These females were bred individuals, which were fed squares until normal deposition started. Consequently this series does not show the effect of the boll food upon the fecundity of the females, but

simply shows the relative effect of the bolls and squares upon the act of oviposition. Table XVI shows the activity of nine females treated in this manner.

TABLE XVI.—*Fecundity of females of Anthonomus grandis on cotton squares and cotton bolls on alternate days.*

Eggs deposited in squares.			Eggs deposited in bolls.		
Total.	Maximum per day.	Average per day.	Total.	Maximum per day.	Average per day.
10	2	0.36	16	2	0.58
21	8	1.28	6	2	.12
24	6	2.00	5	1	.50
21	9	5.26	6	3	1.50
5	3	.28	8	3	.46
40	11	2.42	19	3	1.16
25	7	1.36	16	5	.86
23	5	1.54	11	2	.74
4	3	.16	1	1	.12
37	11	1.42	21	4	.80
41	9	1.52	12	3	.68
251	11	1.21	121	5	.59

From this it is seen that the average eggs per female per day was 1.21 on cotton squares and 0.59 on bolls. Consequently the greater suitability of the square for deposition is quite evident.

Summary of all fecundity observations on cotton squares.—Table XVII gives a brief summary of the foregoing studies on fecundity when the females were with males throughout life and were fed cotton squares. Here it is seen that the three series containing *thurberiae* females gave the lowest average of total eggs per female, and that the first-generation *grandis* gave the highest. The average eggs per female in all series was 68.2 and the average per day was 1.8.

TABLE XVII.—*Fecundity of all boll weevils on cotton squares: Summary.*

Source.	Number females.	Average eggs per female.	Average oviposition period.	Eggs per day.	
				Average.	Maximum.
			Days.		
Hibernated *grandis*	20	69.85	34.5	2.1	12
First generation *grandis*	13	132.54	50	2.7	12
Second generation *grandis*	5	69.4	22.6	3.1	10
Hibernated *thurberiae*	19	56.2	41.79	1.3	7
First generation *thurberiae*	10	24.4	31.4	3.5	5
Female *grandis* and male *thurberiae*	12	72.5	26	2.8	15
Female *thurberiae* and male *grandis*	18	54	43.2	1.3	8
Total	97				
Average		68.2	37.7	1.8	

The averages are all surprisingly low, the lowest on record for a season for the boll weevil, in fact. In 1902 to 1904, at Victoria, Tex., the females averaged 89 eggs each at the rate of 2.8 per day, while at

the same place in 1913 they averaged 212 eggs each at the rate of 5.9 per day. That this year's low record is not due to the difference in localities is shown by the fact that at Tallulah in 1910 the weevils averaged 208 eggs per female, at the rate of 5.5 eggs per day. The low records of 1915 may have been due to the extremely hot, dry weather prevailing during the period when most of the observations were made.

OVIPOSITION PERIOD.

The oviposition period of 122 females was observed during 1915. The results are shown in Table XVIII.

TABLE XVIII.—*Oviposition period of the boll weevil on cotton squares.*

Source of weevils.	Season.	Number of females.	Period.		
			Maximum.	Minimum.	Average.
Hibernated *grandis*	May–June	20	65	1	34.5
Hibernated *grandis* unfertilized in spring.	June–August	25	77	15	40.0
First generation *grandis*	June–September	13	74	19	50.0
Second generation *grandis*	do	5	40	7	22.6
Hibernated *thurberiae*	do	19	74	19	41.79
First generation *thurberiae*	July–September	10	59	10	31.4
Male *thurberiae* and female *grandis*	June–September	12	48	6	26.0
Male *grandis* and female *thurberiae*	do	18	68	20	44.3
Total	May–September	122			
Weighted average					38.2
Maximum			77		
Minimum				1	

The table shows that the oviposition period ranged from 1 to 77 days, with an average of 38.2 days for all females. The first generation *grandis* had the longest average period and the second generation *grandis* the lowest. There is no great difference between the length of the oviposition periods of *grandis* and *thurberiae*.

A series of 8 *thurberiae* females on cotton bolls averaged 25.5 days, with a maximum of 59 days and a minimum of 1 day, while a series of 11 *grandis* females on cotton bolls averaged 29 days, with a maximum of 61 days and a minimum of 6 days.

Observations of 32 females on cotton squares at Tallulah in 1914 showed an average oviposition period of 34.4 days, a maximum period of 80 days and a minimum period of 10 days. The average oviposition at Tallulah in 1910 was 34.44 days, and the average period in Texas in 1913 was 35.8 days. All records of female oviposition periods average several days less than the 1915 record of 38.2 days at Tallulah. Thus it is seen that if there is any tendency toward a change in the length of the oviposition period of the weevil it is in the nature of an increase rather than a decrease.

RATE OF OVIPOSITION.

The rate of oviposition by thirds of the period is shown in Table XIX. From this it is seen that the general average eggs per female per day was the same in the first and second thirds, while in the last it was lower.

TABLE XIX.—*Rate of oviposition of the boll weevil obtained in all experiments.*[1]

Nature of weevils.	Number of females.	Season.	Rate of oviposition.					
			First third of period.		Second third of period.		Last third of period.	
			Total eggs.	Daily avg.	Total eggs.	Daily avg.	Total eggs.	Daily avg.
Hibernated *grandis*	19	May to Aug...	505	2.3	504	2.2	387	1.7
First generation *grandis*	13	June to Sept..	578	2.7	692	3.2	453	2.0
Second generation *grandis*	5	July to Sept...	152	4.2	122	3.3	77	1.9
First generation *thurberiae*	10	....do.....	133	1.3	65	.6	46	.4
Hibernated *thurberiae*	19	June to Sept..	407	1.6	379	1.4	282	1.0
Male *grandis* and female *thurberiae*	18	.... do.....	397	1.5	373	1.4	198	.8
Male *thurberiae* and female *grandis*	13	.... do.....	289	2.7	392	3.5	275	2.3
Total			2,461		2,527		1,718	
Average				2.1		2.1		1.4

[1] Owing to the fact that the oviposition periods were rarely exactly divisible by 3 it was frequently necessary to allow a difference of a day on one or more of the periods. For this reason the divisors used in computing the final average were slightly different, and consequently the same average per day was secured in the first and second period, though the total eggs were slightly higher in the second period.

MAXIMUM NUMBER OF EGGS PER DAY.

The maximum number of eggs deposited by a female in a day was 15, this number being deposited on July 17 by a *grandis* female fertilized by a *thurberiae* male. This maximum is much lower than the maxima of previous years. The maxima of the various series carried through this year varied from 5 to 15 eggs.

The record for maximum eggs per day was made at Tallulah in 1914 when a first generation female laid 27 eggs. The maximum number of eggs in a day before this time was 26, this record being made by a female at Victoria, Tex., in 1913.

PERIOD FROM DEPOSITION OF LAST EGG TO DEATH.

The number of days from the deposition of the last egg to the death of the female varied from 54 days to death on the same day as the last deposition. The average of the 120 weevils observed during the season was 5.8 days. Typical *grandis* averaged 4.4 days to death, the periods of the individuals varying from none to 13 days. Typical *thurberiae* averaged 9.7 days, the periods varying from none to 54. Female *grandis* mated with male *thurberiae* averaged 2.3 days, the periods varying from none to six, while female *thurberiae* mated with male *grandis* averaged 6.2 days, the period varying from none to 24 days.

This period in the 1914 studies varied from 22 days to death on the same day that the last egg was deposited, with an average of 3.4 days. Death on the last day of deposition was observed five times during the season.

ACTIVITY OF FEMALES IN DIFFERENT PARTS OF THE DAY.

Early in August, 1914, two tests were conducted to determine the egg-laying activity of the females during the different parts of the day. Nine actively depositing females were used in each test. The results are shown in Table XX.

TABLE XX.—*Periodic division of oviposition of boll weevils.*

FIRST TEST: AUGUST 4 AND 5.

Period.	Length of period.	Total eggs laid.	Percentage of total oviposition in each period.	Maximum temperature.
			Per cent.	° *F.*
Dawn	5 a. m. to 9 a. m.	16	12.8	77
Morning	9 a. m. to 1 p. m.	47	37.6	86
Afternoon	1 p. m. to 5 p. m.	29	23.2	90
Evening	5 p. m. to 8 p. m.	23	18.4	85
Night	8 p. m. to 5 a. m.	10	8.0	75

SECOND TEST: AUGUST 7 AND 8.

Dawn	5 a. m. to 9 a. m.	8	9.1	72
Morning	9 a. m. to 1 p. m.	27	30.7	81
Afternoon	1 p. m. to 5 p. m.	39	44.3	86
Evening	5 p. m. to 8 p. m.	10	11.4	80
Night	8 p. m. to 5 a. m.	4	4.5	75

SUMMARY: BOTH TESTS.

Dawn	5 a. m. to 9 a. m.	24	11.3	77
Morning	9 a. m. to 1 p. m.	74	34.7	86
Afternoon	1 p. m. to 5 p. m.	68	31.9	90
Evening	5 p. m. to 8 p. m.	33	15.5	85
Night	8 p. m. to 5 a. m.	14	6.6	75

From this table it is seen that in the first test the greatest activity was exhibited in the morning period and the afternoon period ranked second, while in the second test the afternoon period was highest and the morning period was second. In both cases the night was the lowest of all.

The only other test of this sort which has been conducted was at Tallulah during 1910 when it was found that the afternoon period ranked first and the evening period was second. However, this test was conducted during July and the one this year was in August, so the results are not strictly comparable owing to differences in the light and temperature conditions during the various periods.

CESSATION OF OVIPOSITION BY HIBERNATED WEEVILS.

Observations on the date of cessation of oviposition were made with 45 hibernated females collected in the field early in the season and fed on cotton squares. As shown in Table XXI the dates ranged from June 9 to August 23 and the average date of cessation in both series was July 17. All the females excepting two laid eggs on June 20 or later and a majority laid eggs well along in July. Since these females were nearly all selected from the first to appear in the spring it is certain that the later emerged adults would continue to oviposit considerably longer in the fall. Thus the futility of late planting of cotton to escape boll weevil attack is seen.

TABLE XXI.—*Dates of cessation of oviposition of first hibernated females of the boll weevil.*

With males throughout life.		Females isolated from males in spring.		With males throughout life.		Females isolated from males in spring.	
Date collected.	Date stopped ovipositing.	Date collected.	Date stopped ovipositing.	Date collected.	Date stopped ovipositing.	Date collected.	Date stopped ovipositing.
May 26	Aug. 3	June 1	June 29	June 17	Aug. 23	..do....	July 15
Do	June 9	..do....	July 10	Do	July 18	..do....	Aug. 13
Do	June 26	..do....	Aug. 22	Do	July 14	..do....	July 3
Do	June 29	..do....	July 19	Do	June 20	..do....	Aug. 23
Do	July 5	..do....	July 21	Do	Aug. 4	..do....	July 17
Do	June 28	..do....	June 28	Do	Aug. 5	..do....	June 26
Do	June 18	..do....	July 8		.....	..do....	Aug. 20
Do	July 19	..do....	July 19		.....	..do....	July 22
Do	July 10	..do....	June 30		.....	..do....	July 24
Do	July 12	..do....	Aug. 4		.....	..do....	July 3
Do	July 8	..do....	July 4		.....	..do....	July 7
Do	July 31	..do....	July 30	Earliest date stopped	June 9	.....	June 26
Do	June 23	..do....	Aug. 17	Latest date stopped	Aug. 23	.....	Aug. 23
June 17	July 31	..do....	July 17	Average date stopped	July 13	.....	July 20

TOTAL DEVELOPMENTAL PERIOD.

Observations of 1914.—The time required from egg deposition to adult emergence was observed with all weevils bred in the various series until September 5. The maximum developmental period of any weevil was 20 days and the minimum period was 11 days. The results are tabulated according to season and generation in Table XXII.

TABLE XXII.—*Total developmental period of the boll weevil: Observations of 1914.*

Nature of weevils.	Larval food.	Period of oviposition.	Number males bred.	Male weevil days.	Average period.	Number females bred.	Female weevil days.	Average period.	Total number bred.	Total weevil days.	Average period.
					Days.			*Days.*			*Days.*
First generation	Cotton squares.	June 2–July 2	3	44	14.7	7	110	15.7	10	154	15.4
Second generation.	do	June 23–June 30	2	31	15.5	3	45	15	5	76	15.2
Do	do	July 1–5	11	170	15.5	18	269	14.9	29	439	15.2
Do	do	July 8–12	14	200	14.3	16	230	14.4	30	430	14.3
Do	do	July 13–20	50	753	15.1	41	603	14.7	91	1,356	14.9
Do	do	July 21–31	104	1,475	14.1	92	1,303	14.2	196	2,778	14.2
Do	do	Aug. 1–5	40	598	15	34	509	15	74	1,107	15
Do	do	Aug. 6–11	33	495	15	25	375	15	58	870	15
Do	do	Aug. 12–31	16	245	15.3	26	384	14.8	42	629	15
Do	do	Sept. 1–15	5	72	14.5	15	232	15.5	20	304	15.2
Total			275	4,039	14.7	270	3,950	14.6	545	7,989	14.6+
Third generation	do	July 15–21	20	279	14	17	242	14.2	37	521	14.1
Do	do	July 22–26	21	305	14.5	30	436	14.5	51	741	14.5
Do	do	July 27–31	14	204	14.6	13	187	14.4	27	391	14.5
Do	do	Aug. 2–10	14	208	14.9	22	330	15	36	538	15
Do	do	Aug. 11–24	9	127	14.1	11	164	15	20	291	14.6
Total			78	1,123	14.4	93	1,359	14.6	171	2,482	14.5
Fourth generation.	do	Aug. 2–10	14	211	15.1	18	266	14.8	32	477	14.9
Do	do	Aug. 11–23	22	312	14.2	29	416	14.3	51	728	14.3
Total			36	523	14.5	47	682	14.5	83	1,205	14.5
Fifth generation	do	Sept. 2–5	5	72	14.5	6	86	14.3	11	158	14.4
Total			397	5,801	14.6	423	6,187	14.6	820	11,988	14.6

During the entire season 397 males and 423 females were bred. The average developmental period for both sexes was 14.6 days. Weevils bred later than September required a much longer developmental period but no positive record was kept of these weevils.

Observations of 1915.—The total developmental periods of all weevils observed during 1915 is detailed in Table XXIII.

TABLE XXIII.—*Total developmental period of the boll weevil: Observations of 1915.*

GRANDIS WEEVILS.

Source of weevils.	Larval food.	Oviposition period.	Males.			Females.			Total number bred.	Total weevil days.	Average period.
			Number bred.	Weevil days.	Average period.	Number bred.	Weevil days.	Average period.			
					Dys.			*Dys.*			*Dys.*
Hibernated weevils	Cotton squares	June 1–Aug. 23	97	1,383	14.3	105	1,443	13.7	202	2,826	14
Do	do	June 2–Aug. 23	91	1,264	13.9	87	1,193	13.7	178	2,457	13.8
First generation	do	June 26–Sept. 7	44	629	14.3	54	739	13.7	98	1,368	14
Second generation	do	July 23–Sept. 5	6	93	15.5	9	131	14.6	15	224	14.9
Grandis bred weevils	Cotton bolls	July 12–Sept. 16	7	115	16.4	13	209	16.1	20	324	16.2
Total			245	3,484	14.2	268	3,715	13.9	513	7,199	14

THURBERIAE WEEVILS.

Weevils extracted from bolls.	Cotton squares	June 28–Sept. 9	55	792	14.4	49	709	14.47	104	1,501	14.43
First generation	do	July 24–Sept. 20	16	234	14.6	7	95	13.6	23	329	14.3
Extracted from bolls	Cotton bolls	July 28–Sept. 24	4	57	14.3	6	97	16.3	10	154	15.4
Total			75	1,083	14.4	62	901	14.5	137	1,984	14.48

HYBRIDS.

Male *grandis* by female *thurberiae*.	Cotton squares	June 28–Sept. 7	50	689	13.78	63	827	13.13	113	1,516	13.42
Male *thurberiae* by female *grandis*.	do	June 28–Sept. 19	52	726	14.0	51	719	14.1	103	1,445	14
Total of all varieties.		1915	422	5,982	14.2	444	6,162	13.9	866	12,124	14

The average total period for both sexes in both squares and bolls was 14 days. The developmental period in bolls is seen to be greater than in squares with both *grandis* and *thurberiae* weevils. In cotton bolls the *grandis* weevils averaged 16.2 days and the *thurberiae* weevils averaged 15.4 days.

The total developmental period for females is slightly shorter than for the males, which agrees with the observations at Victoria, Tex., in 1913. The average developmental period is apparently a day or more shorter at Tallulah than at Victoria in the same season. There seems to be no difference of note in the records for the various years.

In addition to these studies an experiment was conducted to determine the relative length of the developmental period in squares and bolls when the eggs were deposited by the same female. For this purpose 11 pairs of bred *grandis* were mated on cotton squares until they started normal deposition; then they were given squares and bolls on alternate days and the eggs deposited in them were saved for adult emergence. The comparison of the results is shown in Table XXIV.

TABLE XXIV.—*Comparative developmental period of the boll weevil in squares and bolls from eggs deposited by females offered these foods on alternate days.*

Total eggs deposited.	In cotton squares.										In cotton bolls.										
	Males.			Females.			Both sexes.			Percentage of eggs producing adults.	Total eggs deposited.	Males.			Females.			Both sexes.			Percentage of eggs producing adults.
	Total bred.	Weevil days.	Developmental period.	Total bred.	Weevil days.	Developmental period.	Total bred.	Weevil days.	Average developmental period.			Total bred.	Weevil days.	Developmental period.	Total bred.	Weevil days.	Developmental period.	Total bred.	Weevil days.	Developmental period.	
			Days.			*Days.*			*Days.*					*Days.*			*Days.*			*Days.*	
10	1	14	14				1	14	14	10	16										
22				3	43	14.3	3	43	14.3	13.6	6	1	16	16	1	17	17	2	33	16.5	33.3
24	4	56	14	1	21	21	5	77	15.4	20.8	5				2	31	15.5	2	31	15.5	40
32	3	44	14.7				3	44	14.7	9.4	6	3	55	18.3	3	54	18	6	109	18.2	100
5	1	16	16	1	15	15	2	31	15.5	40	8										
66	2	37	18.5	5	80	16	7	117	16.7	10.6	19	3	45	15	4	62	15.5	7	107	15.3	36.8
28	3	40	13.3	1	13	13	4	53	13.2	14.3	16	4	70	17.5	3	54	18	7	124	17.7	43.8
26				2	27	13.5	2	27	13.5	7.7	11	2	30	15	2	33	16.5	4	63	15.8	36.4
4											1										
40	3	38	12.7	2	29	14.5	5	67	13.4	12.5	21	1	16	16	4	70	17.5	5	86	17.2	23.8
41	2	39	19.5	2	27	13.5	4	66	16.5	9.8	12	4	67	16.8	3	49	16.3	7	116	16.6	58.3
Total, 298	19	284		17	255		36	539			121	18	299		22	370		40	669		
Average			15			15			15	12.1				16.6			16.8			16.7	33.1

Here it is seen that the weevils reared from squares averaged 15 days while those from bolls averaged 16.7 days. The comparative percentages of eggs producing adults are also interesting. Of those laid in squares, 12.1 per cent produced adults while 33.1 per cent of those in bolls produced adults. This is undoubtedly due to the fact that some of the squares were too small to feed the larvæ to maturity and also to the fact that when two or more eggs hatch in the same square the shortage of food usually results fatally to both. The greater deposition in the squares is very marked.

EFFECT OF SIZE OF SQUARE ON WEEVIL DEVELOPMENT.

In July, 1915, an experiment was conducted to determine the effect of the size of the cotton square on the weevil developmental period. An abundance of clean squares was placed in a large wire cage with fertile females and left for one day. The squares containing single eggs were separated into lots of 50 squares each; one lot being small squares, one medium-sized, and the third large. The small squares produced one weevil in 14 days, the medium-sized squares produced 20 weevils in an average of 14.1 days, and the large squares produced 18 weevils in an average of 14.5 days. While the number of weevils reared is too small to make the results conclusive, it seems that the length of the developmental period is directly proportional to the amount of food available. This appears quite probable in view of the fact that the developmental period is always considerably longer in cotton bolls than in cotton squares. The small squares seemed not to furnish sufficient food for the weevil development as only one weevil was able to reach maturity in the 50 tested.

GENERATIONS.

One series of weevils was carried through the season of 1914 to determine the maximum number of generations possible in cotton squares in one year. For starting the series hibernated females were collected immediately after emergence in the spring and placed with males on cotton squares. The first eggs of these females were saved and the progeny reared. The first adults to mature from these were mated and their first eggs secured. This procedure was followed through the season, and the results are shown in Table XXV. Between the first of June and the first of November these weevils were carried through seven generations, the first and only weevil of the seventh generation emerging November 1. This individual was very weak and died in a few days, but as the cold weather at this time had stopped all breeding in the field it was evident that the limit of the breeding season had been reached.

TABLE XXV.—*Number of generations of the boll weevil: Maximum series on squares.*

Generation.	Date.	Period from maturity to maturity.
		Days.
First generation:		
Eggs laid	June 1	
Generation mature	June 22	
Second generation:		
Eggs laid	June 23	
Generation mature	July 9	18
Third generation:		
Eggs laid	July 15	
Generation mature	July 28	20
Fourth generation:		
Eggs laid	Aug. 2	
Generation mature	Aug. 18	22
Fifth generation:		
Eggs laid	Sept. 2	
Generation mature	Sept. 17	31
Sixth generation:		
Eggs laid	Sept. 18	
Generation mature	Oct. 8	22
Seventh generation:		
Eggs laid	Oct. 13	
Generation mature	Nov. 1	24

At Victoria in 1913 the weevils were carried through the same procedure and the same number of generations secured. However, the first hibernated females at Victoria were secured over a month earlier than those at Tallulah and the breeding continued a few days longer in the fall. In other words, the generations were sufficiently shorter at Tallulah to allow the same number to be produced in more than a month less than at Victoria.

SUMMARY.

In northern Louisiana the average longevity of the boll weevil adults on cotton squares was 54.56 days; on bolls 31.41 days; on cotton leaves 8.17, and on okra fruit 5.4, the average for these different classes of foods being 14.13 days.

The females live somewhat longer than the males, there being an average of 12.5 days for females and 9.82 for males.

A number of weevils were found feeding in okra blooms in the field but attempts to cause them to breed in okra fruit in the laboratory were unsuccessful. A number of eggs were deposited but they failed to hatch.

The largest number of eggs deposited by the first generation weevils was 204, the average being 132. The daily maximum varied from 5 to 12. Second generation weevils showed somewhat less fecundity, the maximum oviposition being 175 eggs and the average 69.4.

The average period of oviposition was 38.2 days, the range being 1 to 77 days.

The greatest activity of the weevil in depositing eggs was found to be between the hours of 9 a. m. and 1 p. m., but certain numbers of eggs were deposited at all times of the day and during the night.

The average period from oviposition to the emergence of the adult was practically 14 days for each of the five generations.

Seven complete generations were developed at Tallulah during the season.

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